

Remarks

The Examiner's Office action, mailed March 2, 2006, has been reviewed. In view of the amendments herein and the following remarks, Applicant submits that all the pending claims are allowable.

The Examiner rejected claims 1-11, 17-20, and 25-36 as unpatentable under 35 U.S.C. § 102(e) as anticipated by U.S. Patent Application Publication No. 2003/0037692 in the name of Liu. Reconsideration is requested.

The apparatus of Applicant's claims 1 and 26 and the method of claim 18 all include an oxygen-rich material. In Applicant's original claims, this oxygen-rich material was defined as promoting the burning of hydrocarbons in the formation. This feature is not found in Liu.

Three features are present in all the embodiments taught by Liu: (1) a shaped charge containing a stoichiometric excess of aluminum; and (2) an initial reaction capable of producing molten aluminum from the excess aluminum in the charge; and (3) exploding the charge under conditions in which the molten aluminum is contacted with water or a water solution to produce an "aluminum-water explosion." For example, in paragraph 0080 of the application, it is stated:

... Since the production of molten state aluminum is always associated with the detonation or rapid combustion of an explosive device, the use of the present invention creates a "dual-explosion". The first explosion is from the reaction of the explosive device, and the second being the Al--H₂O reaction. ...

As explained in paragraph 0141 of Liu:

Upon detonation of the charge, a shaped charge liner made of aluminum or aluminum-based materials, ... is firstly heated by shock wave and by the detonation products to a temperature high enough to melt the liner. Then when it is propelled into the formation, it is further heated by the friction with the formation (kinetic energy carried by the jet is partly turned into thermal energy) and it reaches an even high temperature. FIG. 9 illustrates the Al--H₂O reaction

process after perforating. Shown in the figure is a steel casing 50, concrete lining 60 and the hydrocarbon-bearing formation 70. A perforation 80 is created by the shaped charge jet. There is a crushed zone 90 that has low permeability as stated previously, and a layer of molten aluminum 100 applied right on top of the crushed zone. Immediately after perforating, there is a pressure increase in the well due to the release of a substantial amount of detonation products from the charges. Consequently, ***water 110 in the well is forced to enter the perforation 80, reacting explosively with the molten aluminum 100 there.*** [emphasis supplied]

Thus, in the shaped charge of Liu, the “oxygen-rich” material is selected to produce molten aluminum because of its explosive reactivity with water. There is no teaching in Liu of using the “first explosion” to deliver the oxygen-rich material into the formation so that the oxygen-rich material can then promote the burning of hydrocarbons, as recited in Applicant’s original claims. Indeed, this would be contrary to the teachings in Liu.

Applicant has amended claims 1, 18 and 26 to clarify that the oxygen-rich material “is not explosively reactive with water and is capable of fueling the burning of hydrocarbons in the formation regardless of the presence of water in the well when the explosive is ignited.” Thus, Applicant’s invention expressly excludes the charges taught by Liu. Accordingly, Liu does not anticipate either claim 1 or claim 15.

Regarding claim 26 specifically, it defines a shaped charge apparatus comprising a container with a plurality of shaped charges surrounded by oxygen-rich material. Included in the container are end or delivery charges of low order explosives to blow the oxygen-rich material out through the perforations formed by the shaped charges. This apparatus is not disclosed or suggested in any of the cited references, whether considered separately or in combination. With respect to Liu, and specifically referring to Figure 17, no end charges (non-shaped) formed of low order explosives are disclosed; rather, all the charges 280 are similarly formed shaped charges for perforating the formation.

Since claims 2-11, 17, 19-20, 25 and 27-36 all depend directly or indirectly from one of the independent claims, the dependent claims likewise are novel over Liu. Withdrawal of the Section 102 rejection of claims 1-8, 10, 15-17, 19 and 24 based on Liu respectfully is requested. Based on the foregoing, it is submitted that all of pending and examined claims 1-11, 17-20, and 25-36 are patentable over the cited reference.

Withdrawn claims 14-16 depend from amended claim 1, and withdrawn claims 21 and 24 depend from amended claim 18. Since claims 1 and 18, as amended, are drawn to allowable subject matter, Applicant now requests consideration of these withdrawn claims.

New claims 37-41 have been added. Independent claim 39 relates to a shaped charge (not as part of the container) comprising the oxygen-rich material previously discussed. Claims 38, 39, 40 and 41 depend from claim 37 are directed to the embodiments of the shaped charges shown in Figures 5, 6, 7 and 8, respectively, and correspond generally in subject matter to original claims 14, 15, 16, and 17.

Allowance of claims 1-11, 14-21, and 24-36 courteously is solicited. If the Examiner has any questions or comments concerning the instant application or this Amendment, the Examiner is invited to contact the undersigned.

This is intended to be a complete response to the Office action of March 2, 2006.

Respectfully Submitted,

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